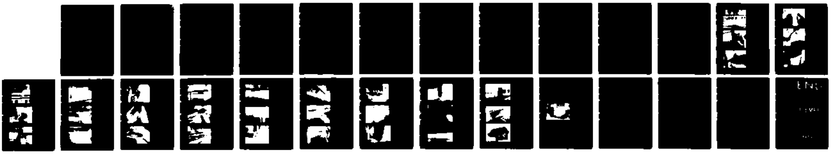
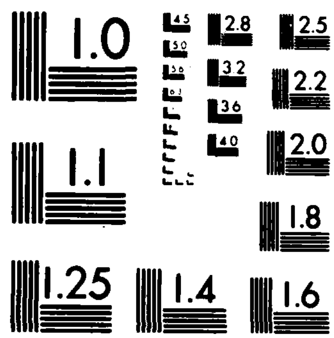
AD-A148 836 BI-PAC F-15 EXTERNAL FUEL TANK CONTAINER MODIFICATION 1/1
(U) AIR FORCE PACKAGING EVALUATION AGENCY
WRIGHT-PATTERSON AFB OH E J KOWALSKI SEP 84
UNCLASSIFIED PTPD-84-R-02 F/G 13/4 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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PTPD REPORT NO. 84-R-02
AFPEA PROJECT NO. 84-P-111
AD NO. 538026

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BI-PAC F-15 EXTERNAL FUEL TANK CONTAINER MODIFICATION

HQ AFLC/DSTZ
AIR FORCE PACKAGING EVALUATION AGENCY
Wright-Patterson AFB OH 45433-5999

September 1984

NOTICE

request was made

ABSTRACT

Warner-Robins ALC/DSTD and ILC/SRS, Robins AFB, Georgia 31098, requested assistance from the Air Force Packaging Evaluation Agency (AFPEA), Wright-Patterson AFB, Ohio 45433, to test and evaluate BI-PAC Fiberglass Containers, NSN 1560-01-017-0858FX, used for shipment/storage of F-15, 600-gallon external fuel tanks. Reports from WR-ALC/DSTD indicated that damage was occurring to the fuel tanks while in transit.

Inspection and evaluation by AFPEA revealed a need for container modifications. Tie-down rings, stacking posts, restraint bars, and stowage positions of these items were modified.

Results of the in-house testing indicate that the F-15, 600-gallon external fuel tanks can be shipped safely in the modified BI-PAC containers.

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INTRODUCTION

Background: Warner-Robins ALC/DSTD and ILC/SRS, Robins AFB, Georgia 31098, requested assistance from the Air Force Packaging Evaluation Agency (AFPEA), Wright-Patterson AFB, Ohio 45433, to test and evaluate BI-PAC Fiberglass Containers used for the shipment and storage of F-15, 600-gallon external fuel tanks. Reports from WR-ALC/DSTD indicate that extensive damage has been experienced during shipments of the F-15 fuel tanks. Initial inspection by the AFPEA indicated that the design of the container required some modifications.

Purpose: The purpose of this project was to:

a. Evaluate container(s) and determine deficiencies.

b. Make design changes to improve performance of the container(s).

c. Test design changes and prepare engineering data for use by WR-ALC.

TEST SPECIMENS

Two each BI-PAC containers, NSN 1560-01-017-0858FX, with F-15, 600-gallon fuel tanks were received from WR-ALC/MMT, Robins AFB, Georgia 31098. The containers were fabricated in 1976 and are of fiberglass material. The container exterior size is 272 x 85 x 45 inches, cube is 602 ft^3 and the gross weight is 1,325 pounds. (Figure 1)

The BI-PAC containers were received at the AFPEA in the following condition:

a. Figure 2, Damage noted to side of *Container No. 1.

b. Figure 3, Seam of strap broken, Container No. 1.

c. Figure 4, Rotation of fuel tanks, Container No. 1.

d. Figure 5, Loose strap, corner post stowage, Container No. 1.

e. Figure 6, Loose strap, tank forward end, Container No. 1.

f. Figure 7, Loose angle iron in forklift entry, **Container No. 2.

(NOTE: *Bottom container during shipment to AFPEA.
**Upper container during shipment to AFPEA.)

The following modifications were applied to containers No. 1 and No. 2 before testing:

a. Figure 8, Tie-Down Ring

b. Figure 11, Stacking Post

c. Figure 16, Stacking Post in Stowage Position

d. Figure 17, Stacking Post in Stowage Position

e. Figure 18, Restraint Bar

f. Figure 24, Restraint Bar in Stowage Position

g. Figure 35, Marking Diagram

Two sets of restraint bars were fabricated. One set of restraint bars was fabricated from one-inch x 0.125 wall square structural steel tube and one set of restraint bars was fabricated from 1½-inch x 0.188 wall square structural steel tube.

TEST OUTLINE AND TEST EQUIPMENT

Tests were conducted in accordance with the AFPEA Container Test Plan, Project No. 82-P-111, dated 7 May 1984 (Table 1). Test methods and procedures used were as outlined in Federal Test Method Standard (FTMS) No. 101 and MIL-A-8421. Equipment used for the test was as follows:

a. Forklift, 4,000 Pound Capacity.

b. Pendulum-Impact Tester fabricated in accordance with Figure 1 of FTMS 101, Method 5012.

c. L.A.B. Corporation Vibration Machine, Serial No. 56801, Type 5000-96B.

d. Edison Hydraulic Load Maintainer.

TEST PROCEDURE AND RESULTS

Test No. 1c: The Pendulum-Impact Test was conducted in accordance with FTMS No. 101, Method 5012. The verticle drop height was nine-inches and the velocity was seven feet per second (fps). The restraint bars used for this test were fabricated from one-inch square structural steel.

Results: At impact, the fuel tanks moved forward 3 5/16-inches. The front cushions were damaged and slight fiberglass damage was noted on the end wall of the container from one of the fuel tank forward movements. The restraint bars had a 3/4-inch deflection set from the forward motion of the container impact. At impact, 5.5 Gs were recorded. Test results were not acceptable and the testing was discontinued. A restraint bar was fabricated from heavier material and the testing was continued.

Test No. 1c (Repeat): The Pendulum-Impact Test was conducted in accordance with FTMS No. 101, Method 5012. The verticle drop height was nine-inches and the velocity was seven feet per second (fps). The restraint bars used for this test were fabricated from 1½-inch square structural steel.

Results: At impact, the fuel tanks moved forward 1 3/8-inches. Both end cushions were crushed slightly from the forward impact of the containers. At impact, 6.5 Gs were recorded. After the test, no visual damage was noted to the fuel tanks, the container, or to the container modifications. Test results were acceptable and the testing was continued.

Test No. 1a: The Cornerwise-Drop (Rotational) Test was conducted in accordance with FTMS No. 101, Method 5005.1. The height of the drop was 15 inches.

Results: On the second Cornerwise-Drop (Rotational) Test, damage occurred to the corner stacking post. One end of the corner post was sheared and the corner post fell on top of the fuel tank. No damage occurred to the fuel tank. The stacking posts were modified and testing was continued (Figure 11 and 12). Visual inspection after the 3rd and 4th cornerwise drops (rotational) revealed no damage to the fuel tanks, the container, or the container modifications. Results of the tests were acceptable.

Test No. 1b: The Edgewise-Drop (Rotational) Test was conducted in accordance with FTMS No. 101, Method 5008.1. The height of the drop was 15 inches.

Results: Visual inspection, after the test, revealed no physical damage to the fuel tanks, the container, or to the container modifications. Results of the tests were acceptable.

Test No. 2a: The Vibration Test was conducted in accordance with FTMS No. 101, Method 5019.1. The container was placed on a vibration table and vibrated for two hours at 3.6 Hz, 1.0 G (Figure 25).

Results: Visual inspection, after the test, revealed no physical damage to the fuel tanks, the container, or the container modifications. Results of the tests were acceptable.

Test No. 2b: The Vibration Test was conducted in accordance with FTMS No. 101, Method 5019.1. The containers were stacked (two high), placed on a vibration table, and vibrated for two hours at 3.8 Hz, 1.0 G (Figure 26). Note container strapping, straps approximately 20-inches from the container ends and also at the center of balance. Straps were used during the test for the safety of personnel and container balance and not to simulate tie-down conditions during transit.

Results: Visual inspection, after the test, revealed no physical damage to the fuel tanks or to the container modifications. However, damage was noted to the fiberglass containers (Figures 27, 28, 29, and 30). Damage to the side walls, ends, and bottoms of the containers are an extension of damage on the units as received from the field. Environmental conditions, because of outdoor storage as well as container wracking when in transit, are contributing factors in the rupture of the fiberglass materials. Results of the tests were acceptable.

Test No. 3: The Tie-Down Strength Test was conducted in accordance with MIL-STD-648, paragraph 5.8.4, and MIL-A-8421, paragraph 3.3.4. A 6,000 pound maximum load was required for the Tie-Down Strength Test (Figure 31 and 32).

Results: Visual inspection of the tie-down rings and the container side walls revealed no damage at the 6,000 pound loading. However, the test was continued until the side wall of one of the modified tie-down rings ruptured (Figure 34). A test load of 14,700 pounds was applied to the tie-down rings before the side wall ruptured. Results of the test were acceptable.

CONCLUSION

In-house testing of the modifications applied to the containers fabricated in 1976 indicate that the F-15, 600-gallon fuel tanks can be shipped safely in these modified containers. Caution should, however, be exercised in the selection of the BI-PAC Container, NSN 1560-01-017-0858FX, before the modifications are applied. All BI-PAC containers should be inspected for stress cracks and/or other damage and should be repaired only if material and labor cost are within the specified limits of the initial container cost. No modifications should be applied to unserviceable containers.

RECOMMENDATION

Stress cracks should be repaired or they will continue to propagate and thus cause additional damage to the BI-PAC containers. The stress cracks may weaken the walls, ends, or bottom to a point where they may collapse and cause damage to the fuel tanks.

It is also recommended that shipment(s) of BI-PAC container(s), with fuel tanks, be made on flat-bed trailers that will fully support the 272-inch length and the 85-inch width of the container(s). No overhang of the container(s) should be permitted because the design of the container(s) requires a full support of the base. Any amount of overhang on the trailer will cause container(s) flexing and lead to a possible collapse of the side walls.

Container markings should be stenciled on both sides of the container as an attention notification to the transporter (Figure 35).

TABLE I

AIR FORCE PACKAGING EVALUATION AGENCY (Container Test Plan)					AFPEA PROJECT NUMBER 84-P-111	
CONTAINER SIZE (L X W X D)(INCHES) INTERIOR:	EXTERIOR: 272"X85"X45"	WEIGHT (LBS) GROSS: 1325	ITEM:	CUBE (CU. FT.) 602	QUANTITY 2	DATE 7 May 84
ITEM NAME F-15 600-Gallon Fuel Tank			MANUFACTURER Plastics Research Corp.			
CONTAINER NAME Bi-Pac, NSN 1560-01-017-0858FX					CONTAINER COST N/A	
PACK DESCRIPTION Fiberglass Construction						
CONDITIONING Ambient						

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO's	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
1.	ROUGH HANDLING TESTS			
a.	FTMS No. 101, Method 5005.1	Cornerwise-Drop (Rotational) Test, 15 inch drop height.	One drop on each corner of the container base (four drops).	N/A
b.	FTMS No. 101, Method 5008.1	Edgewise-Drop (Rotational) Test, 15 inch drop height.	One drop each edge of the container base (two drops)	N/A
c.	FTMS No. 101, Method 5012	Pendulum-Impact Test, 9 inch Test, 9 inch drop height, 7 fps impact.	One impact to each end (two impacts)	N/A
2.	VIBRATION TEST			
a.	FTMS No. 101, Method 5019.1	One inch double amplitude within the range of 3 to 5 Hz, 2 hours.	As required by test	N/A
b.	FTMS No. 101, Method 5019.1	One inch double amplitude within the range of 3 to 5 Hz, 2 hours.	Stack 2 high, as required by test.	N/A
3.	TIE-DOWN STRENGTH TEST			
	MIL-STD-648, Para 5.8.4 MIL-A-8421, Para 3.3.4	Forward 3 X Gross Weight Aft 1½ X Gross Weight Lateral 1½ X Gross Weight Up 2 X Gross Weight Down 4½ X Gross Weight	As required by test	N/A

COMMENTS

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EDWARD J. KOWALSKI, Mechanical Engineer	RALPH ZYNDA, Chief, Design Br, AFPEA

AFALD FORM 4

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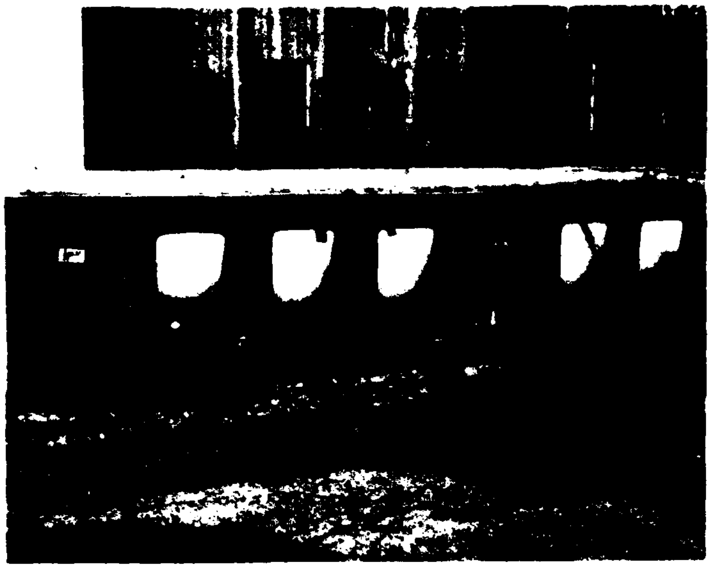

Figure 1, Bi-Pac Container
NSN 1560-01-017-0858FX

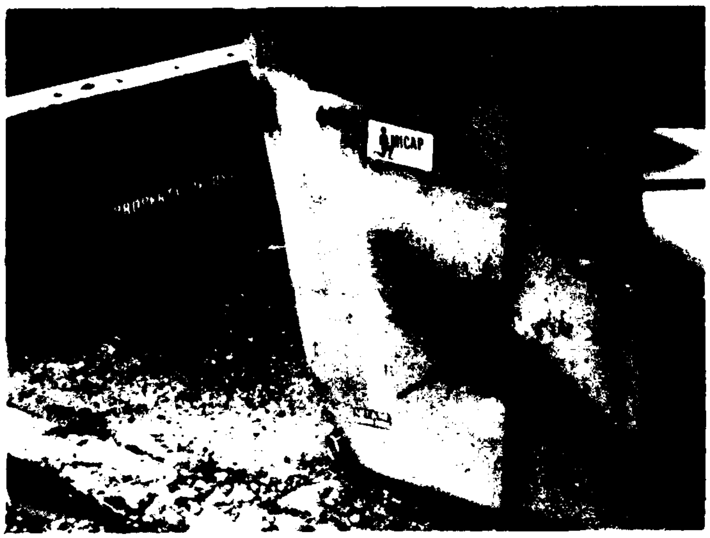

Figure 2, Container Damage,
Side View

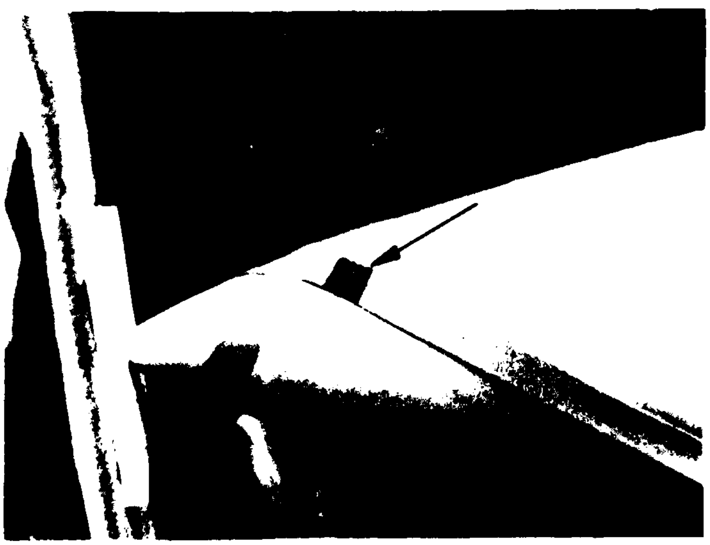

Figure 3, Strap Damage

Figure 4, Fuel Tank Rotation

Figure 5, Loose Strap,
Corner Post

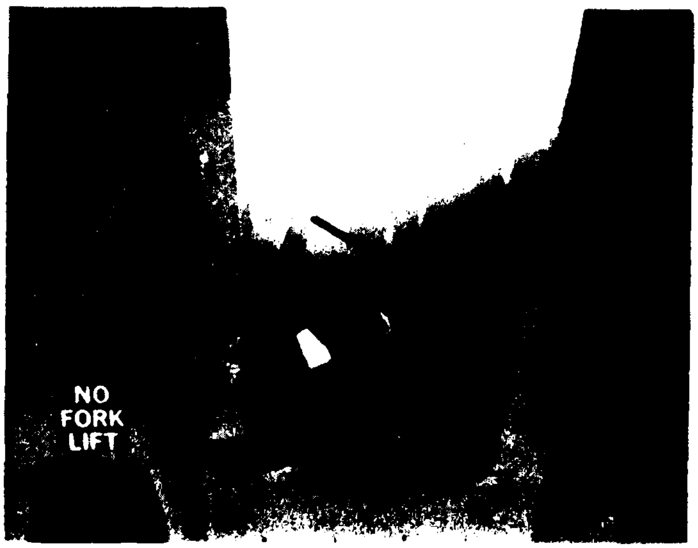

Figure 6, Loose Strap, Fuel
Tank Forward End

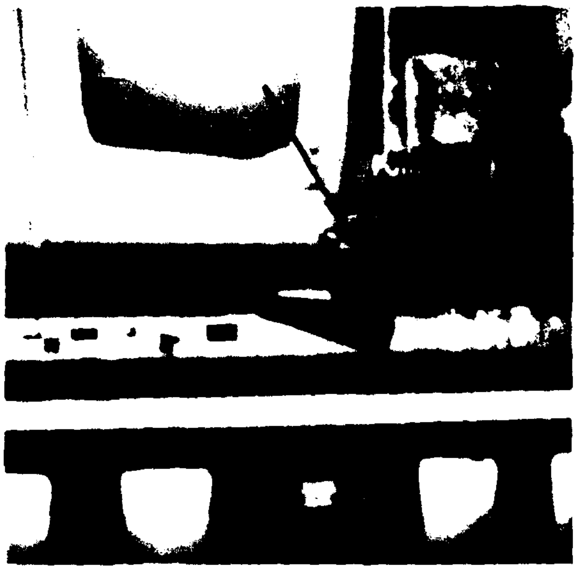

Figure 7, Loose Angle Iron,
Forklift Entry

Figure 8, Tie-Down Ring
Installation

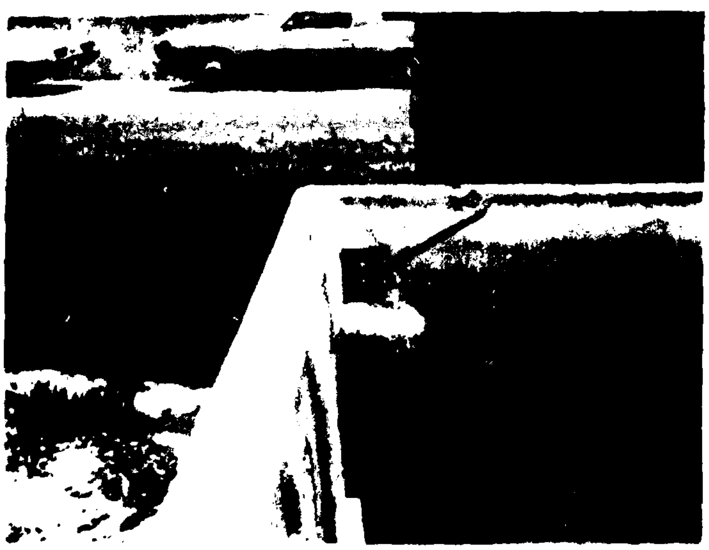

Figure 9, Back-Up Plate, Tie-
Down Ring Installation

Figure 10, Tie-Down Ring Clearance, Container Stacking

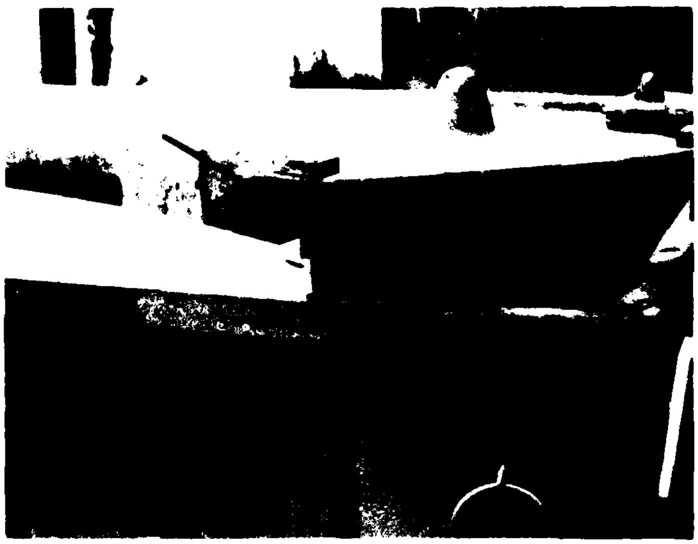

Figure 11, Stacking Post Modification

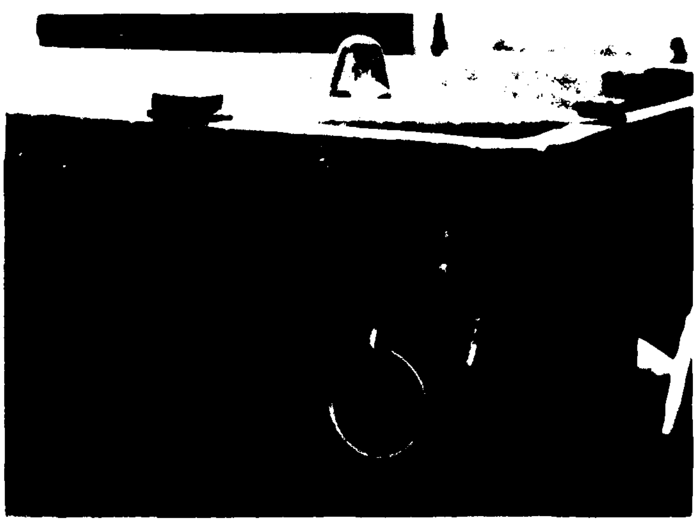

Figure 12, Stacking Post Installed

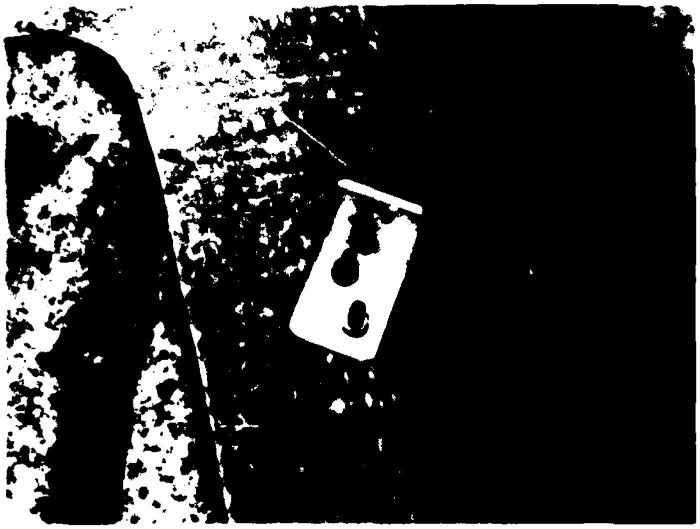

Figure 13, Stacking Post
Bracket Installation
Stowage Position

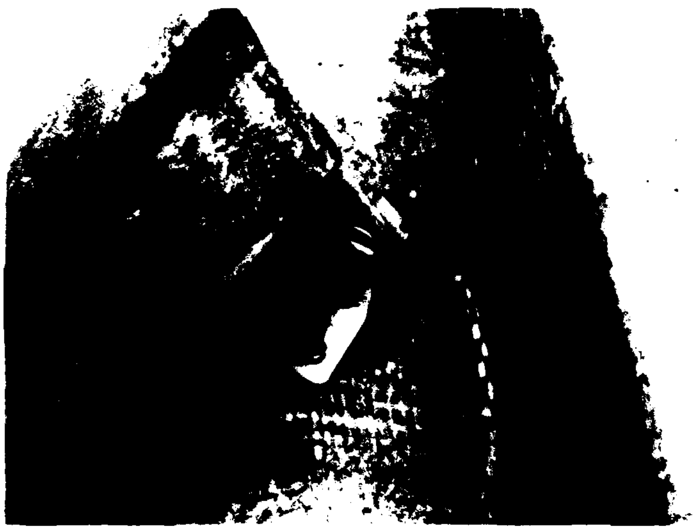

Figure 14, Stacking Post in
Stowage Position,
Guide Pin Assembly

Figure 15, Stacking Post Metal
Strap Modification

Figure 16, Stacking Post in Stowage Position

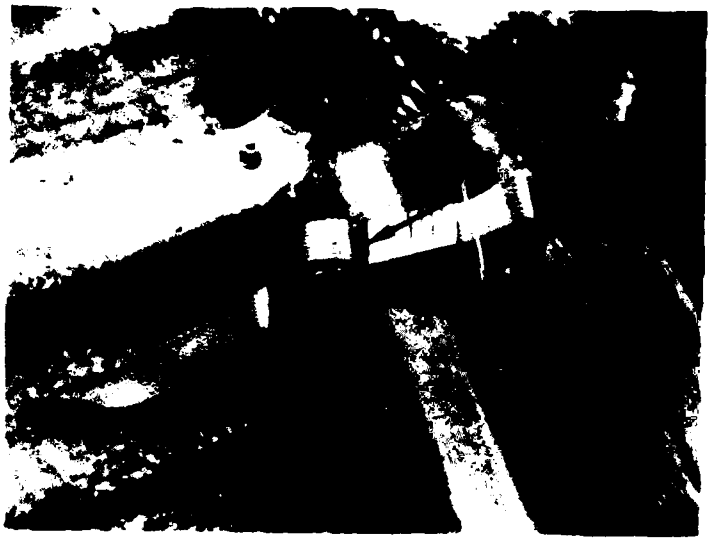

Figure 17, Stacking Post in Stowage Position, Nylon Strap Modification

Figure 18, Restraint Bar Modification

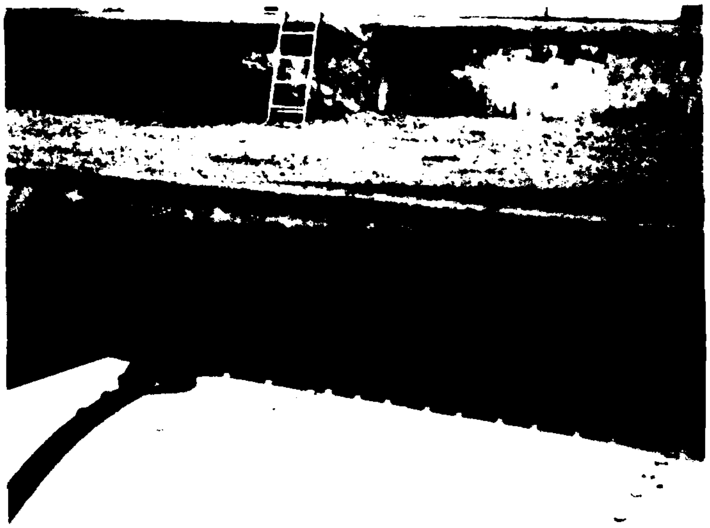

Figure 19, Restraint Bar Modification

Figure 20, Back-Up Plate, Restraint Bar Installation

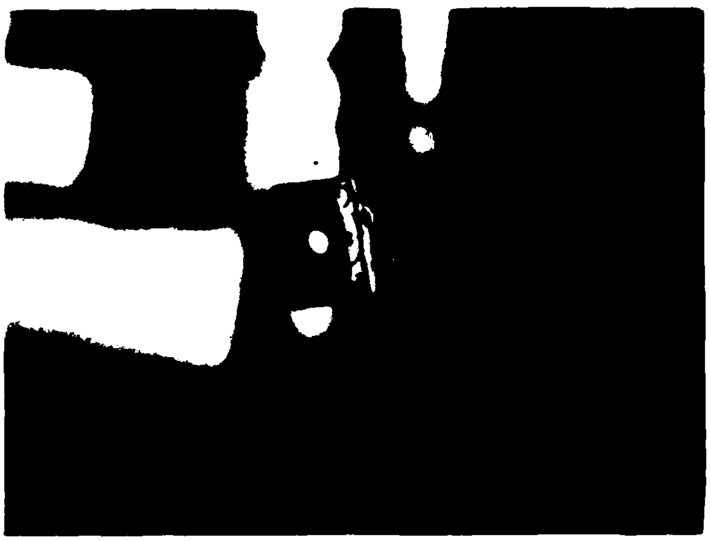

Figure 21, Restraint Bar End

Figure 22, Restraint Bar,
Fuel Tank Mounting Lug

Figure 23, Restraint Bar,
Stowage Position

Figure 24, Restraint Bar,
Stowage Position

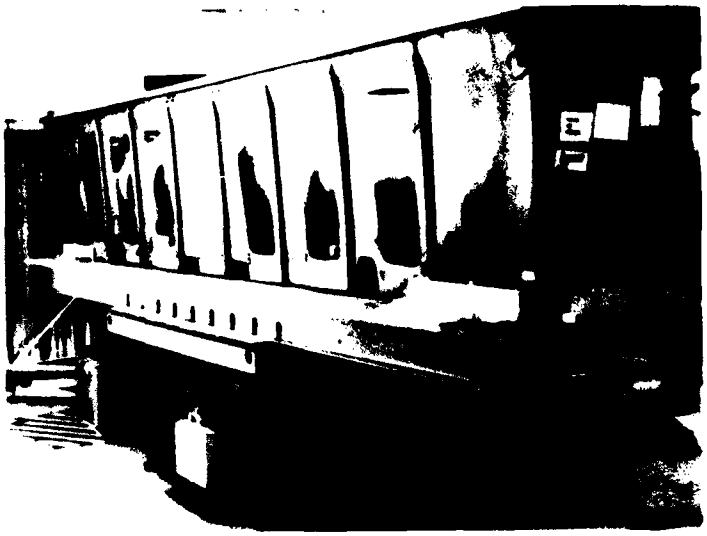

Figure 25, Vibration Test

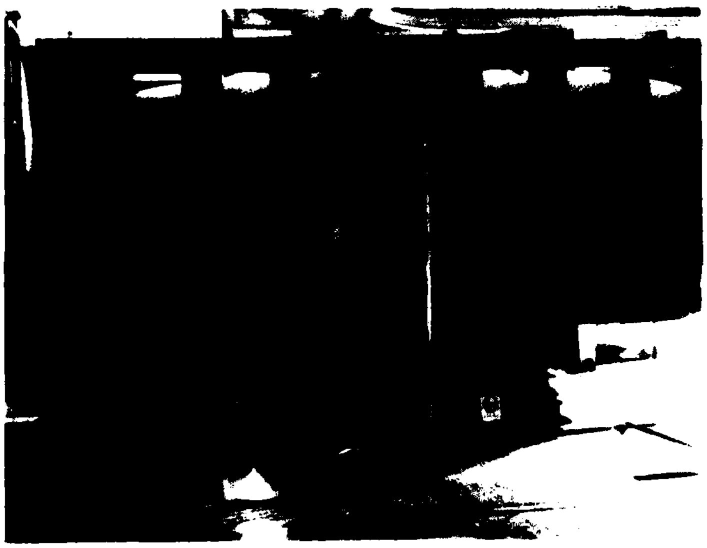

Figure 26, Vibration Test,
Stacked

Figure 27, Container Damage,
Side Wall

Figure 28, Container Damage, Side Wall

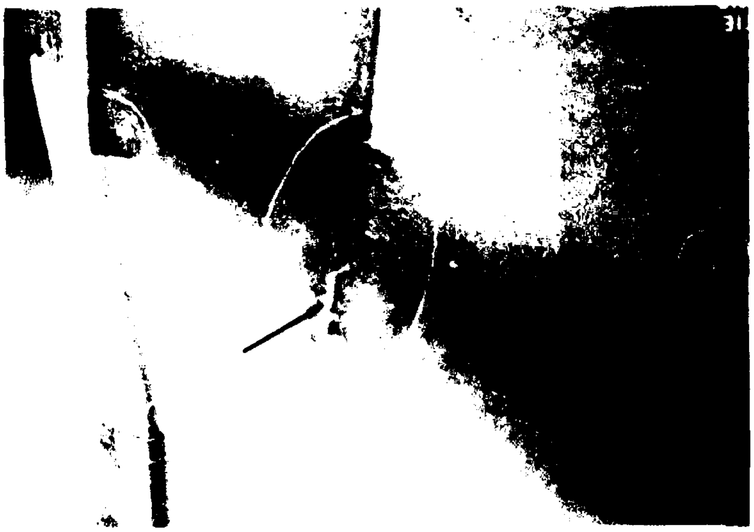

Figure 29, Container Damage, Side Wall

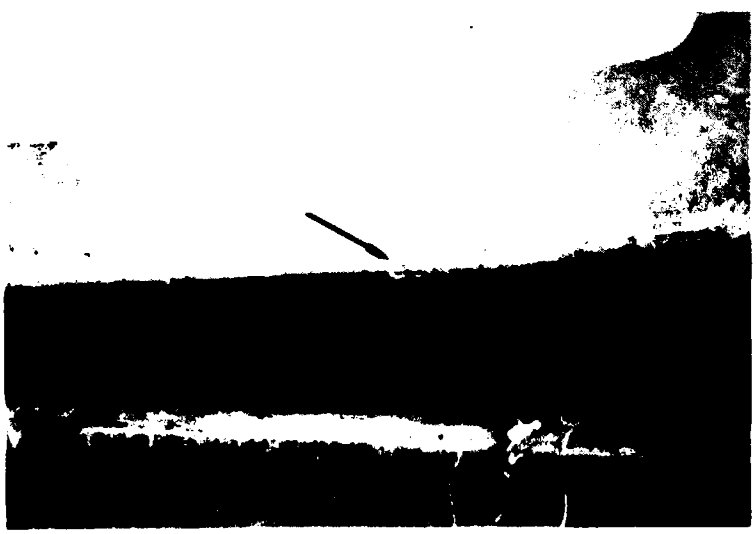

Figure 30, Container Damage, Bottom

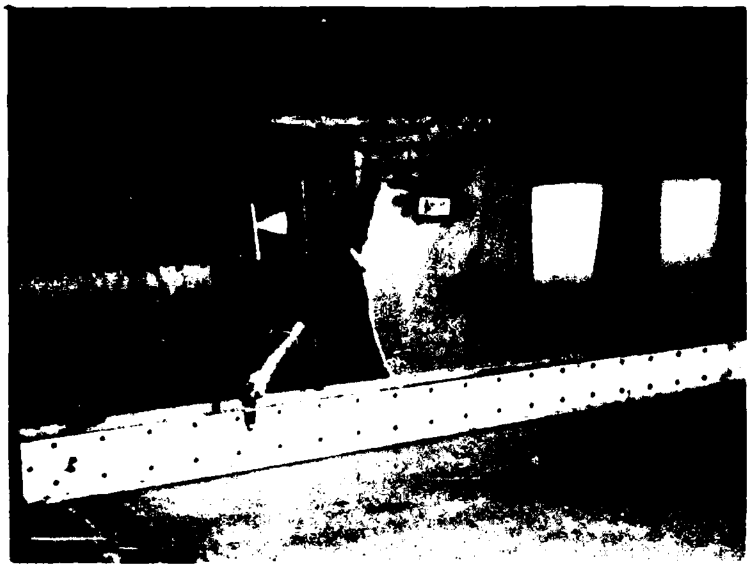

Figure 31, Tie-Down Ring Test

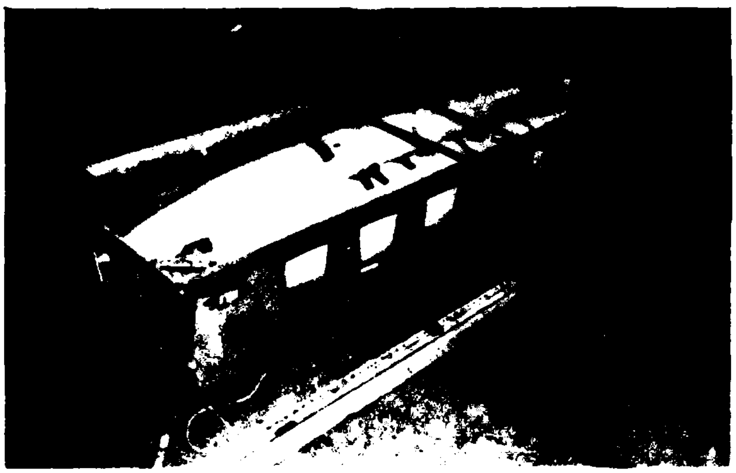

Figure 32, Tie-Down Ring Test

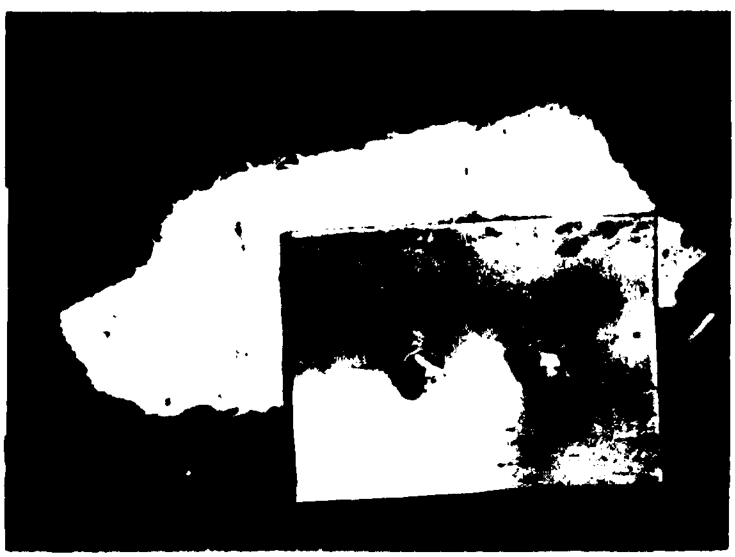

Figure 33, Tie-Down Ring, Side Wall Rupture

Figure 34, Tie-Down Ring,
Side Wall Rupture

BIPAC CONTAINER MARKING DIAGRAM

NOTES:

1. LETTERS ½ IN. UNLESS SPECIFIED
2. 4 PLACES
3. 2 PLACES
4. RESTRAINT BAR BACKING PLATE LOCATED ON OUTSIDE OF CONTAINER

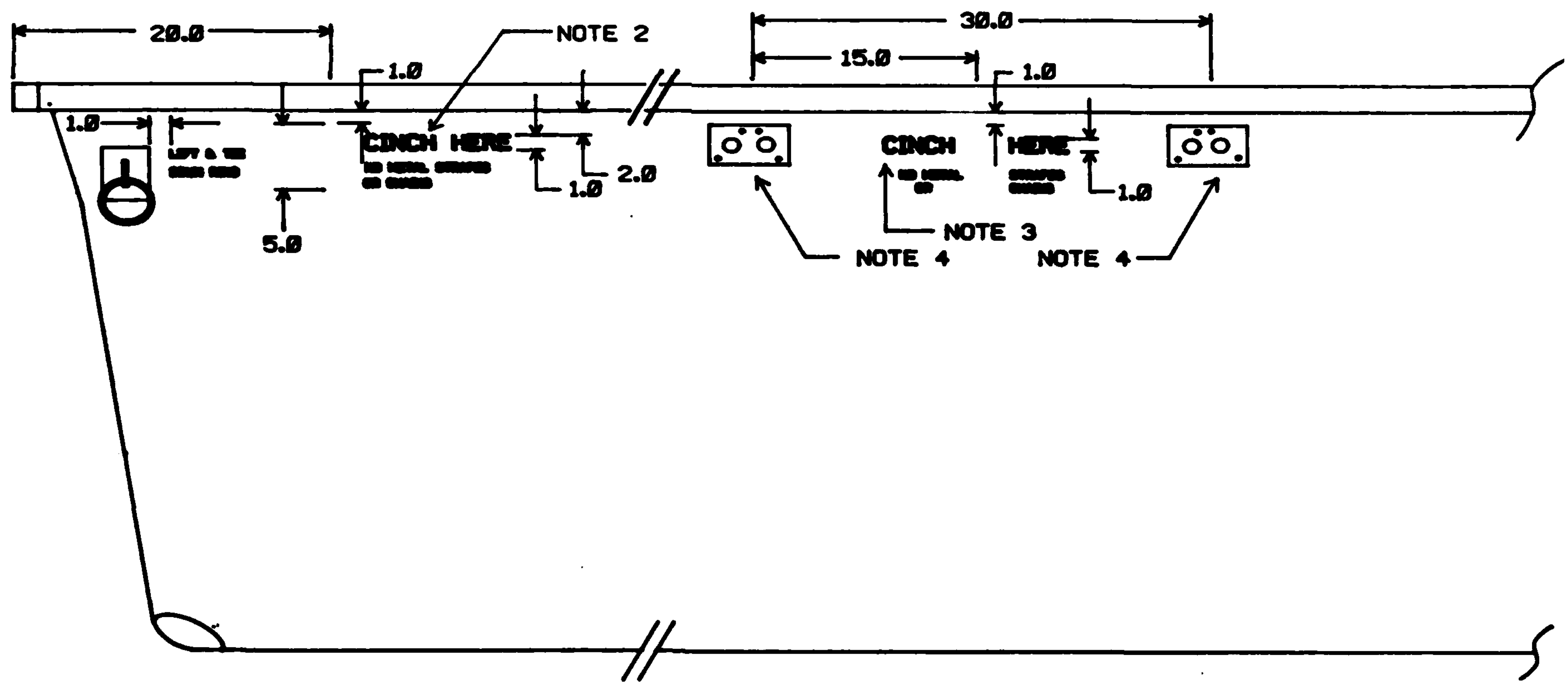

Figure 35

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